

DYING JUNGLE

Research to save the fragile Green Hell

In the last 20 years the population of Latin America has exploded, as it has everywhere; the pressure of people shows the Amazonian jungle's vaunted invincibility to be a myth

The primary Amazonian rain forest ranks with sequoias and blue whales among the world's most impressive biological phenomena.

It can almost be considered four forests on one ground, growing in strata. Wherever a little light filters down, something green grows; plants live on plants living on plants.

Massive trees rise above a profusion of species, low plants with leaves like tablecloths, trees which gyre and gimble in the search for the sun, palms, thorny stands of bamboo, orchids which grow on anything with enough of a notch to hold them, even on heavy lianas which in their turn drape from third-story branches. It is impossible to be satisfied that one knows all the kinds of plant which grow in a particular spot; closer inspection seems always to reveal something new.

This environment is a habitat for an equally varied fauna. Every class of animal has exploded into a constellation of species in the abundance of the rain forest. Where one might see 10 species of river birds along a mile of temperate-zone stream, in the rain forest there are 100.

Thus it is startling to hear scientists say that all this profusion is within a narrow margin of being as barren as the Sahara.

Notwithstanding adventure stories in which the Green Hell of the jungle inexorably swallows man's works, the rain forest appears to be the precariously balanced result of eons of biological thrift. Built on some of the world's poorest soils, it is unable to withstand much tampering and certainly is not able to sprout like magic on cleared land.

Amazonia now is on the verge of an ecological crisis, a result of the impact of Latin America's booming population. With little forethought or scientific knowledge, and little heed for past disasters, crude agriculture is tipping the house of cards that is the rain forest. The jungle is being cut and burned at a great rate. The resulting cleared land is of marginal quality and yields crops for only a few years, whereupon the occupants move and more jungle is cut.

At the same time a host of demands, for science, for pets, for food, for fur, for sport hunting, is encroaching on, and destroying, the diverse fauna.

Alarmed by this, the international Association for Tropical Biology, formed in 1963, has held several meetings on Amazonian ecology. The most recent two were held in January in Colombia, which contains a particularly hard-hit portion of Amazonia.

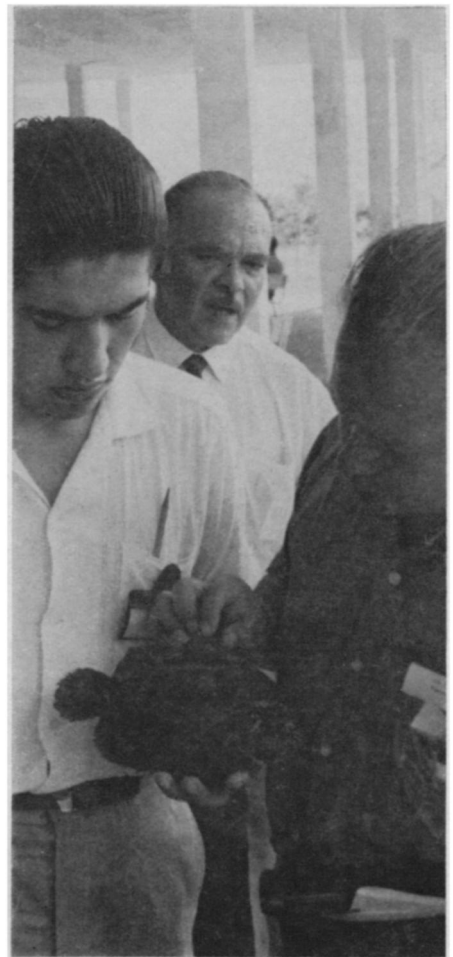
Sutton, Blair and Cowan (above, from left) were among the U.S. delegates to the meeting. Right, scientists gather for an open-air general session where a few decades ago rain forest stood. Far right, Dr. J. M. Idrobo, president of the Association for Tropical Biology, examines a new species of fresh-water flounder with a student from Colombia's National University.

The first meeting was a symposium in the town of Florencia, the second a round-table discussion in the Amazon River town of Leticia.

Scientists from The Netherlands, Germany, England, France and much of Latin America attended. United States representatives at the meeting were Dr. W. Frank Blair, chairman of the U.S. National Committee of the International Biological Program, Myron Sutton, assistant chief of the National Park Service's Division of International Affairs, and Dr. Richard S. Cowan, director of the Smithsonian Institution's Natural History Museum in Washington.

The biological kingpin of the rain forest, and the subject of major attention at the meeting, is the mycorrhiza, the symbiotic network of soil fungi and the roots of trees and other higher plants that can be observed in both tropical and temperate forest systems. The nature of this relationship is the subject of much botanical argument, but it is known that it enables forests to survive on very poor soils; some trees cannot grow without fungi on their roots.

At the meeting to put forward a theory of how the rain forest might depend on this underpinning was Dr. Nellie Stark of the Desert Research In-



stitute of the University of Nevada in Reno. Dr. Stark developed the theory with Nevada University colleague Dr. F. W. Went.

According to Drs. Went and Stark, the rain forest uses the soil only as an anchor and a platform. It has long been known that the soils of the Amazon basin by and large are totally leached, containing no stored soluble plant nutrients and releasing by chemical reaction only a microscopic trickle of nutrients.

In the other forest ecologies, the litter of dead leaves in a forest decomposes by bacterial action, releasing soluble nutrients into the soil. Deep feeding roots of plants recapture most of these nutrients. Those that are lost to rainwater leaching are made up from the mineral reserve.

Drs. Went and Stark postulate that in the rain forest, lacking deep fertile soil, the mycorrhiza system breaks down the litter almost as soon as it falls, returning the nutrients directly to the living vegetation without intervention by the soil.

The small amount of nutrients that do reach the soil are immediately leached by the heavy rainfall, and can be replaced only slowly by chemical release from the poor sands and yellow clays that constitute most Amazonian

soils. Dr. Stark notes that most of the nutrients available in the rain forest are contained in living vegetation, the rest in recently fallen litter.

When, in the typical course of events, a colonist cuts the forest and burns it, he destroys the mycorrhiza system and loses the nutrients either in smoke or to rainwater leaching. Then native grasses, containing no nutrients for cattle, cover the ground. Crops, except perhaps rice at first, generally fail to grow. There is a short period of marginal productivity from the land, then it reverts to brush, to begin the slow process of saving up for another forest.

There is a possibility that the conditions necessary for recreating the forest from scratch no longer exist. Geologist Carlos Eduardo Acosta of the National University of Colombia in Bogota, noting the poverty of Amazonian soils, says that if the vegetation disappears "we would have a desert just like the Sahara."

The rapidity with which vegetation is disappearing under the indiscriminate ax of the colonist has many tropical botanists concerned that some species face extinction. Dr. Raul Echeverry of the University of Tolima, Colombia, suggests that botanical gardens be set up to preserve threatened plants, especially useful ones, until the tide can be

turned. In the meantime methods of cultivation could be determined in the gardens. Useful jungle plants include barbascos for the production of the insecticide rotenone, oil palms, *Corchorus capsularis* for fiber, guarana (used to make a caffeine-containing drink in Brazil), and many other industrial species.

Most of the participants dealt with their own specialties: Colombian ornithologist Dr. Antonio Olivares with tropical birds, Brazil's Dr. Jorge Soria with cacao, Dr. Blair with toads, Sutton with national parks in the tropics and anthropologist Dr. Horacio Calle of Colombia with man-forest accommodation. The general realization, however, is that the future of the rain forest depends on extensive, broad, basic studies in all fields.

Mycorrhiza studies, though crucial, are only part of what is required. Much more scientific interest, much more money and many more than the few meetings so far held on tropical biology, are needed in defense of the Amazon's ecology. Colombian Minister of Agriculture Dr. Enrique Penalosa proposed establishment of an Amazonian biology research institute in Colombia, but the effort and money required for the job may go far beyond the resources of any one South American nation.